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(12) # EUROPEAN PATENT SPECIFICATION

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(54) **Apparatus to continuously mix and homogenize powdered substances with liquid substances.**

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EP 0 079 300 B1

Description

The difficulty of continuously mixing powdered substances with liquid substances in the proper liquid-powder proportions while avoiding the formation of lumps has been noted.

This difficulty is particularly present when for example a perfectly homogenous mixture of powdered milk with water or other beverages is desired.

The object of the present invention is an apparatus which resolves the problem in a truly satisfactory manner.

Existing apparatuses do not satisfactorily fulfill the existing requirements.

The GB—A—1.239.319 patent for example relates to an apparatus for the continuous mixing and homogenization of powdered substances with liquid substances, comprising a hopper for supplying the powdered substances into a conveyor screw, which terminates in front of the rotor of an homogenization turbine.

The liquid substances are supplied through an axial bore of said screw.

It is obvious that the powder substances at the exit of the screw may get wet by the liquid substances causing the formation of lumps.

The apparatus which is the object of the invention overcomes said drawback and is characterized in that the outer end of the screw and the inner walls of the housing located between said end of the screw and said rotor of the homogenization turbine, are so shaped to function as a Venturi tube; the liquid substances being introduced under pression at the exterior of the screw in order to create an empty space in the Venturi tube and immediately at the exit of the screw, so as to prevent that the powder leaving the screw gets wet.

The attached drawing clearly shows diagrammatically a preferred but nonlimiting embodiment of the apparatus.

Fig. 1 shows an axial cross section,

Fig. 2 shows the rotor of the turbine,

Fig. 3 shows the diffusor.

In Fig. 1, the apparatus comprises the hopper 1 which contains the powdered substance. The vibrating sieve 2 is arranged in it, and is actuated by the eccentric 11, preferably controlled by its own motor 11' or by another motion element.

The purpose of this sieve is to hold back the extraneous substances which sometimes accompany the powdered substance (pieces of string, old lumps or the like).

At the base of hopper 1 is found the screw 3 which turns inside a housing which terminates with a restriction or narrowed part 5 to slightly compress the powder in such a manner that it is held back when the screw is closed. The screw is supported on support 3' provided with bearings and with a gasket 18 which prevents the powder from entering into the bearings themselves.

A variable speed motor 4 actuates screw 3. The angular speed must be adapted by introduction of the desired quantity of powder, proportioned to the volume of liquid fed into the screw, and the liquid must enter at constant pressure and velocity, controlled by a flowmeter.

Variable speed motor 4 can be replaced by a torque or belt convertor.

In front of the end 5 of the screw 3 it is placed rotor 8 of the homogenization turbine 8, 9, 10.

According to the present invention, the outer end 5 of the screw 3 and the inner walls of the housing 19 located between said end of the screw and said rotor 8 of the homogenization turbine, are so shaped to function as a Venturi tube. The inner walls of said housing 19 are shaped as a converging-diverging chamber.

The liquid substances, introduced under pression through the duct 7 are required to pass through the circular crown nozzle 16 at the exterior of the screw 3 in order to create an empty space 6 in the Venturi tube and immediately at the exit of the screw so as to prevent that the powder leaving the screw gets wet.

This is the most important aspect of the present invention. In fact if this would happen, the powder would coagulate and in short time the screw would be stuck.

To allow the quick cleaning of the end of the screw, it is foreseen that the screw be easily dismountable by means of a bayonette attachment 17 or threaded ring nut.

The liquid discharged at great velocity in the shape of a circle, after having created the empty space 6, is sucked out by turbine 9, 10, which pushes it by centrifugal force, mixed with the powder, through channels 8' and 15 (Figs. 2 and 3). The inclined channels or the rapidly rotating rotor aid in forcing the mixture through channels 15 of the stationary diffusor, which functions as a pump. The mixture is perfectly homogenized by passage through revolving channels 8' and stationary channels 15. Stationary channels 15 can be radial or inclined in the opposite direction from channels 8' of the rotor.

The spaces between ring 9' of the rotor 8 and those of the diffusor 10' is on the order of a few hundredths of a millimeter, to obtain a high degree of homogenization.

The device works in the following manner: first the turbine 9, 10 is started, and when the same has reached maximum speed, a valve placed below the turbine (valve not shown) is opened, thus creating a certain space, then screw 3 is started, and simultaneously a valve for the liquid above (also not shown) is opened, situated to correspond with joint 7.

Thus is initiated the process of mixing and homogenization which can continue without end, until the desired degree of mixing is obtained.

To stop the process, first the screw is stopped, and immediately the valve of the liquid situated above is closed.

After some seconds, when all the mixture is discharged from chamber 20 and from turbine 9, 10, the valve below is closed and the turbine is stopped. To avoid erroneous moves, the starting and stopping sequences are executed auto-

matically.

The apparatus which is disclosed is suited to continuously mix for example powdered milk with water in any quantity in a satisfactory manner. Presently this mixing is done in containers with a certain water content, to which the powdered milk is added and which is mixed by means of a stirrer. To obtain great quantities, very large receptacles with costly installations are used. The disclosed apparatus, which can be attached directly to the bottling or packaging machine for nonreturn packaging, requires only a minimum investment.

It is obvious that the apparatus as disclosed can be adopted for mixing any liquid with any powder.

Claims

1. Apparatus for the continuous mixing and homogenization of powdered substances with liquid substances, comprising a hopper for supplying the powdered substances into a conveyor screw which terminates in front of the rotor of an homogenization turbine, the liquid substances being supplied through a duct, characterized in that the outer end (5) of the screw (3) and the inner walls of the housing (19) located between said end of the screw and said rotor (8) of the homogenization turbine, are so shaped to function as a Venturi tube; the liquid substances being introduced under pression at the exterior of the screw in order to create an empty space (6) in the Venturi tube and immediately at the exit of the screw, so as to prevent that the powder leaving the screw gets wet.

2. Apparatus according to claim 1 characterized in that the end of the screw has a terminal constriction (5) to hold back the powder flowing therefrom; the inner walls of the housing (19) functioning as a Venturi tube, being shaped as a converging-diverging chamber; the liquid substances supplied through an injection conduit (7) passing through a nozzle with circular crown (16) comprised between the external end of the screw and the inner walls of said converging-diverging chamber.

3. Apparatus as in claim 1 and 2, characterized in that the groups comprising the screw (3) is easily dismountable and remountable by means of a bayonette attachment (17) or threaded ring nut, to facilitate cleaning.

4. Utilization of the apparatus according to claim 1, for the homogenization of powdered and liquid substances for food use and in particular for the homogenization of powdered milk with liquids such as water or other beverages.

Patentansprüche

1. Vorrichtung für die ununterbrochene Mischung und Homogenisierung von pulverförmigen Substanzen mit flüssigen Substanzen, wobei ein Beschickungstrichter für die Zufuhr der pulverförmigen Substanzen in eine Förderschnecke, die vor dem Rotor einer Homogenisierungsturbine endet, vorgesehen ist und die flüssigen Substanzen durch einen Kanal zugeführt werden, dadurch gekennzeichnet, daß das äußere Ende (5) der Schnecke (3) und die zwischen diesem Ende der Schnecke sowie dem Rotor (8) der Homogenisierungsturbine befindlichen Innenwände des Gehäuses (19) so ausgestaltet sind, daß sie als ein Venturirohr arbeiten, und daß die flüssigen Substanzen unter Druck an der Außenseite der Schnecke zugeführt werden, um einen Leerraum (6) in dem Venturirohr und unmittelbar am Auslaß der Schnecke zu erzeugen, so daß ein Feuchtwerden des die Schnecke verlassenden Pulvers verhindert wird.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß das Ende der Schnecke eine endseitige Einziehung (5), um das davon abfließende Pulver zurückzuhalten, aufweist, daß die Innenwände des als ein Venturirohr arbeitenden Gehäuses (19) zu einer doppeltrichterförmigen Kammer ausgestaltt sind und daß die durch eine Einspritzleitung (7) zugeführten flüssigen Substanzen durch eine kreisförmige, zwischen dem äußeren Ende der Schnecke sowie den Innenwänden der doppeltrichterförmigen Kammer gebildete Ausflußdüse (16) treten.

3. Vorrichtung nach Anspruch 1 und 2, dadurch gekennzeichnet, daß die die Schnecke (3) umfassende Baugruppe mittels einer Bajonettverbindung (17) oder eines Gewinderinges für eine Erleichterung der Reinigung leicht ab- und wiederanbaubar ist.

4. Verwendung der Vorrichtung gemäß Anspruch 1 für die Homogenisierung von pulverförmigen sowie flüssigen Substanzen bei Nahrungsmitteln und insbesondere für die Homogenisierung von Milchpulver mit Flüssigkeiten, wie Wasser oder anderen Getränken.

Revendications

1. Appareil pour le mélange continu et l'homogénéisation de substances pulvérulentes avec des substances liquides, comprenant une trémie pour fournir les substances pulvérulentes à une vis transporteuse qui se termine en face du rotor d'une turbine d'homogénéisation, les substances liquides étant amenées à travers un conduit, caractérisé en ce que l'extrémité de sortie (5) de la vis (3) et les parois intérieures du boîtier (19) placées entre ladite extrémité de la vis et le dit rotor (8) de la turbine d'homogénéisation sont d'une forme telle qu'elle agissent en tube de Venturi, les substances liquides étant introduites sous pression à l'extérieur de la vis afin de créer un espace vide (6) dans le tube de Venturi et immédiatement à la sortie de la vis de façon à empêcher que la poudre quittant la vis soit mouillée.

2. Appareil selon la revendication 1, caractérisé en ce que la fin de la vis présente un étranglement terminal (5) pour retenir la poudre qui s'en écoule, les parois intérieures du boîtier (19) fonctionnant comme un tube de Venturi en étant en forme

d'une chambre convergente-divergente, les substances liquides fournies par un conduit d'injection (7) passant à travers une embouchure en couronne circulaire (16) comprise entre l'extrémité extérieure de la vis et les parois intérieures de ladite chambre convergente-divergente.

3. Appareil selon les revendications 1 et 2, caractérisé en ce que le groupe comprenant la vis (3) est aisément démontable et remontable au moyen d'une attache à baïonnette (17) ou d'un écrou en bague filetée pour faciliter le nettoyage.

4. Utilisation de l'appareil selon la revendication 1, pour l'homogènéisation de substances pulvérulentes et liquides en vue d'une utilisation d'alimentation et en particulier pour l'homogénéisation de lait en poudre avec des liquides tels que l'eau ou d'autres boissons.

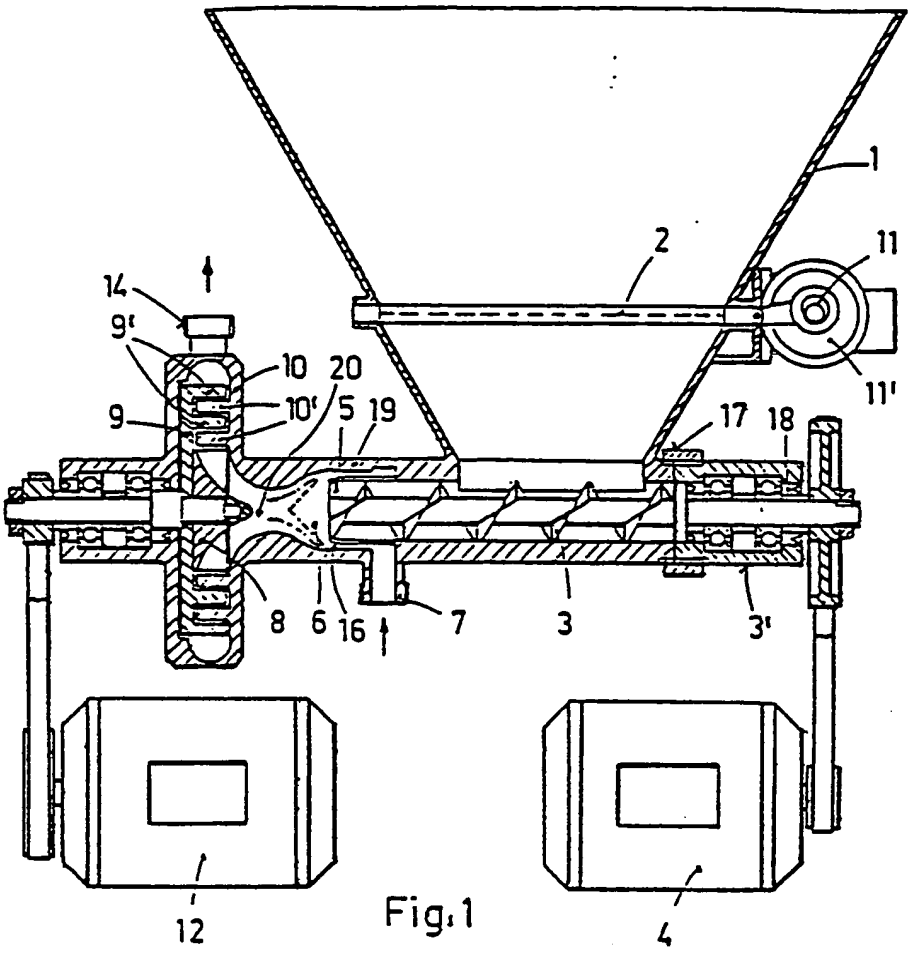

Fig.1

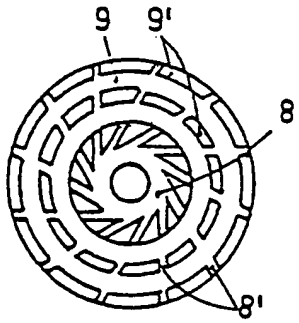

Fig.2

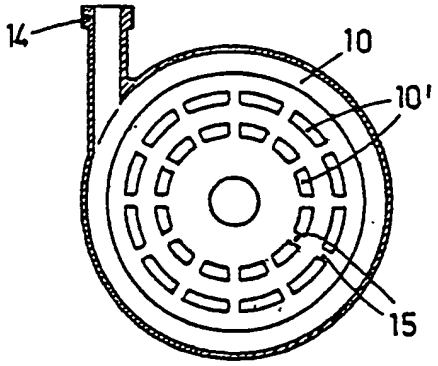

Fig.3